Welcome and Introduction

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Muon Collider Simulation Workshop
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Muon Collider Simulation milestones

- first collider concepts ~1969-1971
  Budker, Skrinsky
- theory of ionization cooling developed ~1965-1983
  Kolomensky, Skrinsky, Parkhomchuk, Balbekov, Neuffer
- early studies followed evolution of transport equations
- early simulations with studied isolated elements ~1994
  e.g. Parmela, Simucool
- first Monte Carlo systems studies ~1994
  MCM, mix of simple simulation & scaling laws
- development of more flexible codes
  ICOOL, DPGeant ~1996
- muon collider status report (1999)

Muon collider status report

- most complete overall description of a muon collider ever
- simulations only of isolated parts
- used non-optimal linear cooling channels
- not self-consistent
- emittance exchange was crude

Developments since 1999

(1) better linear cooling channels
    developed for neutrino factory studies 1, 2, 2a
(2) ring coolers
    6D cooling factors ~100
    injection is still major issue
(3) Balbekov front end design (2003)
    PR + BCR + RC + linear Li channel
(4) theory for gas-filled, helical channel → Muons, Inc.
    early simulation work
(5) progress on non-scaling FFAGs
    current NF designs up to 20 GeV
    need studies for 60 GeV, 1 TeV

Why different from neutrino factory studies?

(1) lots more cooling required
    ~10^6 versus ~4 for study 2a
(2) lots more acceleration required
    ~1 TeV versus 20 GeV in study 2a
(3) all particles consolidated in a few bunches
    2 versus 80 in study 2a
(4) need collider ring
    more difficult than storage ring
(5) need integrated detector in ring
    more difficult than isolated detector
    shielding more critical

Goals for this workshop

- rekindle momentum on muon collider systems simulations
- reexamine critical issues that need to be addressed
- focus ring cooler studies towards specific parts of collider system
- make plans for detailed end-to-end simulation of a muon collider
  - same level of detail as study 2a
  - self-consistent → good/bad beam correlations
  - try to reach status report requirements for front end
    - 0.16 μ/p with $\varepsilon_{6N} = 0.17$ mm^3

Humility is a virtue

- we do not have a defendable scenario for a muon collider now
- we should keep an open mind about different approaches
  - single bunch
  - bunch train with recombination
  - frictional cooling
  - optical stochastic cooling
  - ???